

## **Natural Worlds**

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The colonial encounter with the tropics and the global hunt for resources between 1450 and 1650 under the mercantile capitalism of European empires transformed the natural worlds of the Renaissance leading to a cultural and intellectual efflorescence. This was a period when, as the historian Donald Worster puts it, ‘capitalism became the pioneering, and ... most important, architect of that new integrated world economy’, the environmental impact of European colonial expansion on so much of the world territory became apparent and humans as environmental agents begin to dominate over nature. The idea of a threshold or turning point is key to the debate on changing human nature interactions in the early modern period and defining that moment is a major problem both in terms of the dating and also in terms of a new culture of valuation of the landscape when people became aware of the importance of human agency and its possible damaging effects.

Empires historically have tended to possess the resource demands, the urban needs, the capital and the information networks, command of trade routes on land and at sea, enabling them to increase their carrying capacity and further augment their command of surpluses by landscape transforming colonisations. They also transform the disease environment and create the conditions through their urban and network characteristics for periodic mass mortalities during extreme climate events, introducing an element of great instability as well as transition in populations. The advent of the more seaborne empires in the Renaissance beginning with Venice imposed new demands on timber resources, for example in the Balkans as well as novel patterns of forest administration, early conservation, resource organisation and classification, analysis of soil types and soil erosion. With the development of sugar, in the fifteenth century, a step change occurred in the speed of landscape transformation in the Mediterranean, followed by the East Atlantic, the West Atlantic, the Caribbean, South America and finally the South Atlantic. Plantation agriculture and the rapid developments of markets in high value sugar and other addictive drugs (tea, coffee, tobacco, opium, cocaine) as well as urban foodstuffs from the sixteenth to the eighteenth century further, created the conditions for profitable capital investment in the commodity frontier (Grove 1995, Richards 2003). We begin to see the transformation of the Canaries, Madeira and Cape Verdes, but these are a logical development of the colonization and transformation of many of the Mediterranean islands especially by the Genoese. At the same time, one can see

the emergence of a nascent environmental consciousness and an emerging culture of 'environmentalism' (Grove 1995).

For environmental historians, the recent preoccupation with human induced climate change designated by some earth system scientists as the Anthropocene comes as a surprise as the concept of human-nature interactions over time has long been a central object of their study<sup>1</sup>. Since the 1950s, the Annales School had emphasized the importance of geography and climate in understanding history over what it called "the *longue durée*." Other environmental historians followed such as John F Richards, Donald Worster and Richard Grove who examined the resource demands of early empires. As the eminent historian Worster noted environmental historians had long recognised the cultural history of nature as being as important as the ecological history of culture. For Worster, then the purpose of environmental history, was 'to put nature back into historical studies, or, defined more elaborately, to explore the ways in which the biophysical world has influenced the course of human history and the ways in which people have thought about their natural surroundings'(Worster1996). Grove further argued that to understand the interactions between the natural environment and social structures over the last few millenia in a global frame we need, as a first step, to understand the conjuncture between extreme climate events, the dynamics and features of empires, and their organised responses to the environment, especially to anomalous or unusual events. This does not constitute crude environmental determinism but is a recognition of the role that the environment plays in human affairs and the cultural response of societies to environmental change. This was a view that resulted in the Integrated History and People of the World project (IHOPE) in 2005 when an interdisciplinary group of social scientists, historians, sociologists and scientists came together on a project to integrate socio-environmental interactions over centennial time scales (Contanzas, Graumilch, Steffan 2006).

## **Environmental History and Empire**

It is now an accepted premise that global environmental history must deal with capitalism as cornerstone of the world economy. At the same time,' as John McNeill notes, 'all global history should take account of local conditions whether it is environmental history or any other variety. It requires what natural scientists, especially those who work with satellite imagery, call ground truthing' (Corona 2008). Environmental history has been described as the interdisciplinary study of the relations of culture, technology and nature through time and as the historically documented part of the story of the life and death, not of human individuals but of societies and species in terms of their relationship with the world around them. Some environmental historians argue from a materialist/structuralist perspective

while others argue from a much more cultural perspective. There is some disagreement about whether the natural world constitutes any kind of order or pattern that we can know and, if it does, whether that order can be apprehended by means of science or not. There is also a debate about what is natural and what is not, about whether indigenous people managed the whole environment or only some part of it, and how much was wilderness and how much was mythical. There are also divergent opinions over the extent to which nature influences human affairs, some scholars taking the position of limited environmental determinism, and others insisting that culture determines all. As Caroline Ford has argued, many of the studies in environmental history stress the blurred aspect of the nature-culture divide (Ford 2007).

Environmental history seeks to address the absence of nature in many forms of historical writing. In histories of empire, this absence is particularly marked considering the fact, as Richard Grove argues, that the development of an environmental sensibility among Europeans can be traced to the encounter of European travellers, surgeons, naturalists, medical officers and administrators with environments of the tropics from 1500 and with the recognition of the damage done to these environments by them. Grove's work revises this 'unnatural history' of the empire, and indeed the growing domain of environmental history has taken root in studies of empire. He argued convincingly that from the fifteenth century the global network of trade and travel transformed European understandings of nature. The plethora of information that travellers, surgeons and later scientists of the British, Dutch and French empire gathered from the wider world helped them to build up an understanding of the fragility of nature. The botanic gardens they established on remote islands such as the Canaries and on St Helena became important centres for scientific networking rooted in the knowledge on medicine, climatology and agriculture. The process of botanical garden-making in the period of the renaissance was both about science and culture underlining the garden as an environmental text and a metaphor of mind defining the wellbeing and health of man. It further signalled a new aesthetic valuing of the environment. While the ruling agendas continued to be medical and therapeutic, garden making was highly imitative. The pattern and influence of the garden in Leiden and Amsterdam exercised organising power over the gardens in Paris, Cape, St Vincent and at Calcutta. As Grove notes; 'The garden defined modes of perceiving, assessing and classifying the world in terms of a Hippocratic agenda.' (1995:13) Grove's work voluminously documents and convincingly argues for the originality, vitality and effervescence of colonial science in the colonies from the sixteenth to the nineteenth centuries and the new cultures of knowledge that made possible the emergence of a truly global environmental awareness. It depended on a new empirical knowledge of the scale of the world and actual observations of human ability to change the natural environment on a global basis (Grove 1995).

## **The Resource Frontier of the Early Modern World**

The extension of what Immanuel Wallerstein has called the capitalist “world system” on a global scale between 1200 and 1788 had a critically important dimension in terms of resource exploitation (Wallerstein 2011, Abu-Lughod 2005). During the early modern period, when imperial expansion was becoming a characteristic of state building, humans established new links, primarily by sea, around the entire world and due to maritime improvements a truly global economy emerged. Constitutive of this early modernity was the collections of plants, animals, peoples and voyaging (Winterbottom 2016: 5). Worster has highlighted the maximising culture of early capitalism in terms of consumption patterns and resource use and in the process the destruction and transformation of indigenous societies and cultures. European merchants and companies found that they could exploit the trade goods, markets, and resources of almost every land, in what became an expanding commodity frontier, the “unending frontier” in the title of John Richards important book on the environmental history of the early modern world (Richards 2003). According to Richards, “increased human mobility encouraged the rapid growth of the ‘world hunt’... commercial hunters and gatherers killed off species of wild fish, mammals and birds as well as trees and bushes whose carcasses possessed value in the early modern world economy. Humans voraciously and systematically located, extracted, processed, packaged, shipped, priced, sold and consumed wild animals in ever greater quantities over ever greater distances”(2003:9). The rapidly growing economy put traders in contact with indigenous peoples to procure, timber, furs and medicinal plants often with devastating impact on these peoples. The world hunt also affected the oceans. After about 1400, fisheries extended to an oceanic scale as seals and whales were hunted from pole to pole. The world’s northern oceans became hunting grounds exploited at a new scale and intensity. New seafaring abilities allowed humans beings an expanded access to the resources of the ocean. Mariners outside the Mediterranean ventured outside their coastal waters and covered long distances to hunt fish, whales, seals and walruses. Western Europe became the primary beneficiary of the capitalist world economy controlling interregional maritime trade. Markets centred in that region directed the exploitation of natural resources on a world scale (Richards 2003: 9). As Richards notes, ‘Capital investment moved readily from one world region to another. Prices for commodities quoted in the urban centres of the new world economy sent signals to producers round the globe. New commodities in increasing quantities and variety flowed to world markets. Monetary systems based on metallic forms of money-copper, gold and silver-expanded and

interlinked in new ways. Aggressive trade, war and settlement challenged and shocked isolated and insular local cultures and societies' (2003:1-2).

The argument presented by John F. Richards and Richard Grove about the expanding resource frontier of Europe has also been replicated by other environmental historians notably by Alfred Crosby in *Ecological Imperialism* where he argues that the process of imperial expansion, whether in terms of direct conquest in what Crosby calls the creation of 'neo-Europes' in the temperate world with the colonization of the Americas, Australia and New Zealand, or through indirect disruptions as a consequences of trading patterns and military actions, fundamentally changed many ecological processes. The introduction of horses to the Americas in 1519 by Spanish conquistadors, the humble potato from the Americas to Europe in the 1580s, and rabbits to Australia in the eighteenth century transformed the environments of these places (Crosby 2004). This is not the first time such changes had altered the planet's ecology; the emergence of agriculture and the domestication of animals has meant that the Holocene, the geological period since the last glacial episode, has been a period which saw accelerated anthropogenic-induced changes in most places, but the speed and scale of change in the last half millennium particularly after 1500 is what is most important. But the ecological dimension of such imperialism is what needs much more attention than it has received until relatively recently. Crosby focuses exclusively on the white settler colonies and omits any discussion of the extensive regions of the colonial tropics. When we turn to the tropics we see, for example, that almost every part of Africa was gradually drawn into a world economy dominated by Europe, between the fifteenth and nineteenth century. The period after 1500 which saw the enmeshing of the slave trade and the ivory trade capitalised by Europeans and Indian merchants effectively drew Africa into global networks of trade and exchange<sup>2</sup>.

Tropical environmental history is still a growing field. In Grove's terms, the focus on the political and the administrative dimensions of empire has occluded the material impacts of colonization on people's lives, their culture and on land, animals, fish, forests and other facets of their ecological contexts. The environment has simply been taken for granted until recently when the ecological dimension of human history, is once again being worked into the picture. One of the first symptoms of the early phases of globalisation was the marginalization, enslavement, and then extinction of small indigenous cultures, especially those of island peoples; the indigenes of the Canary Islands are a classic example. However, it was on uninhabited islands such as St. Helena and Mauritius that the full effects of highly capitalized plantations, forest clearance, and import of alien animals (especially pigs, goats, and rats) were first observed. The extinction of the dodo in Mauritius in the mid seventeenth century made a great impression on

contemporary naturalists. The fact that oceanic islands were perceived as highly desirable “Edenic” locations in long-running European cultural traditions served to emphasize the shock of their manifest and rapid degradation. Moreover, their degradation threatened their role as watering and supply stations for company ships. In these circumstances, the colonial governments of many small islands became environmentalist, if only to ensure their own survival and that of their agricultural settlers and slaves (Grove 1995). Grove has examined at some length the cultural meanings of the “edenic” both in Europe and the newly discovered non-European world from 1600 and the ways in which British, Dutch and French scientists drew on their knowledge of remote islands to build up an understanding of the potential fragility and exhaustability of nature. Concentrating on deforestation and the phenomenon of desiccation they operated within an intellectual framework of the renaissance informed by new, dynamic and empirically-rooted ideas in medicine, climatology, agriculture and botany.

Indeed, even before the advent of large continental-based European empires in Asia, Africa, and the Americas, the scale of artificially caused environmental change was already being realised as European maritime countries started to exploit new kinds of natural resources on a global scale. As noted, sugar and other crops essential to the new urban markets of Europe were cultivated on small islands, especially in the West Indies, Indian Ocean, and East Indies. Settler cultivation often took the form of highly intensive industrial agriculture. Colonists cleared the rain forest landscapes to grow and process cane sugar and plantation grown cane sugar became one of the most valuable export products of the early modern world economy, transforming ecosystems and landscapes. The search for sugar was matched by other commodities such as timber, fish, wildlife, exotic plants. As early as the 1670s, the catastrophic consequences of European capital- and labour-intensive activities became clear as the early island colonies experienced drought due to the drying up of perennial streams, soil erosion, dust storms, and the disappearance of animal and plant species (Grove 1995). A hesitantly emerging global consciousness was one of the most profound consequences of the speeded up early modern circulation of peoples. Identifying, naming and classifying of climates, minerals, human groups, animals and plants originated in the taxonomic impulses of enthusiastic observers<sup>3</sup>. The new world had a strong impact on Renaissance man and ‘discovery’ in a global sense transforming their cultural sensibilities and gave them as Grove notes the opportunity to locate Gardens of Eden in an emerging geographical reality with oceanic Islands which were the first to be seen as ‘Edenic’.

### **Indigenous capital accumulation**

Capitalist accumulation and regional trade developed quite autonomously from Europe in South and East Asia in the early modern period. Here too, major transformations of the natural landscape took place under empires whose cultures

of consumption and accumulation compared favourably to Europe. Some developments, like the deforestation of the Ganga basin, by early Indian empires had already been long in progress, but they quickly accelerated after 1400 as powerful empires developed. As Pomeranz notes, two dissimilar early modern states, the Mughal Empire in India and the Dutch republic in Western Europe, successfully powered economies of prodigious productivity (Richards 2003: 24-26). The Mughal Empire in Asia was an agrarian, not a maritime economy<sup>4</sup>. By the mid-seventeenth century, with a large centralised empire of sub-continental proportions and with over 100 million people, Mughal India and in particular the region of Bengal had become a vast granary producing immense surpluses of rice and clarified butter. Cheap, abundant food stuffs encouraged rising artisanal output as Bengal's cotton and silk textiles found a ready and growing market in Asia and Europe. By comparison with the Mughal Empire, the Dutch republic was small, with a population of 1.9 million living in an area of 42,000 square km. Due to a combination of institutional circumstances the Dutch republic came to dominate the shipping and commerce of the early modern world. Dutch shipping had become the most technically advanced in Europe and between 1570 and 1620 Dutch traders cornered the trade in the worldwide rich trades, sugar, furs, slaves, precious metals, diamonds, spices and textile developing new links with the Caribbean, Brazil, West Africa, Northern Russia and the East Indies (Richards 2003:24). The Dutch East India Company became the primary conduit for European trade with Japan, South East Asia, China and India. As great maritime powers, the European mercantile empires quickly outstripped its Asian competitors.

For Immanuel Wallerstein the rise of Europe was the result of a unique combination of relatively free labour, large and productive urban populations and merchants and governments that facilitated long-distance trade and the reinvestment of profits. However, Kenneth Pomeranz has argued that there is little to suggest that Western Europe had economic advantages either in capital stock or institutional advantages in 1600 (Pomeranz 2000). He suggests that European domination of Atlantic trade did not make Europe dominant in terms of financial profits and capital accumulation but it did relieve the strain on Europe's land, energy and resources. For Pomeranz then, Europe's overseas extraction was a crucial factor leading it out of a world of Malthusian constraints. It is not surprising that the great divergence debate emphasises the advantage of Western Europe in terms of resource extraction from the colonies. It was this advantage that was critical to the different trajectories of growth between Europe and Asia, leading to the decline of Asia in economic terms. The historian Parthasarathi Prasannan also has put paid to Smithian, Weberian, and Malthusian arguments with regard to the development of capitalism in Asian societies from the 16<sup>th</sup> century arguing for claim of economic and cultural equivalence with Europe in pre-industrial standards of living, technological capacity, and

institutional efficiency. Furthermore like Grove he examines the ways in which Western Science was actually global science in which Indian knowledge participated from the outset, until British intervention dismantled the court patronage that undergirded scientific inquiry (Prasannan 2011). It was colonisation of India and extraction from the seventeenth century that accounted for the rise of Britain and the decline of India, not cultural stagnation or religion.

## **Botanic Gardens and Plant exchange**

When we focus on some case studies of overseas extraction in the context of Renaissance-era imperial expansion, the importance of exotic plants cannot be underestimated. Indeed, as noted by David Mackay, the economic importance of plant interchange buttressed the philosophy of empire (Mackay 1985). Between 1415 and 1487 the Portuguese built on even older patterns of pharmacological trade in the Indian Ocean region. The study of networks following long distance oceanic trade from fifteenth century demonstrated the shared roots of Indian, Middle Eastern and European medicine and the transformation of European science by indigenous technical knowledge (Grove 1995). In August 1487 Bartholomew Dias had traversed the southern tip of Africa and in 1521 Magellan's fleet had crossed the Pacific and circumnavigated the globe. With the arrival of Vasco De Gama in Malabar in 1498 the scene was set for a rapid exchange of biological and botanical material particularly among Asia, Europe and the Caribbean (1995: 24). The joy of discovery of the minutiae of the tropical world in late 16<sup>th</sup> century traveller's accounts was paralleled by the rise of botanical science and natural history in Europe. The rise of botanical gardens in renaissance northern Italy in Pisa and Padua was one result of these interconnected developments, resulting in the first major book on Asian botany by Gracia Da Orta, a Portuguese physician who lived in Goa published in 1563. The book was translated into Latin by Charles D Ecluse (Clusius) a Flemish doctor and botanist based in Leiden establishing connections between the Dutch botanical establishment and India and leading to the diffusion of knowledge between South West India and the Leiden botanical garden and resulting in the famous *Hortus Malabaricus* of Van Reede in 1678. Grove has argued that both Orta's text and Van Reede's texts privileged Malayali Ayurvedic medical botanical and zoological knowledge and are based on indigenous knowledge. Grove notes the diffusion of medico-botanical knowledge that tended to privilege non-brahmanical epistemologies and impose an indigenous logic. By the seventeenth century this relationship was changing as 'the practices of collecting and transplanting plants, gardening and practicing medicine as well as publishing natural histories were directly linked to the colonial exploitation of



resources’ (Winterbottom 2016:115) Surgeons of the East India Company such as Samuel Browne and Edward Buckley were embedded in networks that involved different European companies, private interests and missionary interests building up a lucrative business of buying and supplying drugs. Both of these men, for example, spent time looking at Indian practices in Madras and reporting them back to their European counterparts in the 1680s. The process of comparison of plants was carried out in botanical gardens which became critical to new ways of thinking about nature and modes of perceiving, classifying and assessing the world, globally and in terms of a Hippocratic agenda (Grove 1995:13, Winterbottom 2016:126). The search for *materia medica* was matched by a surge of interests in other crops such as pepper and cardamom.

As Deepak Kumar argues colonial developments cannot be solely understood in terms of politics or trade. There was he notes ‘ a strong cultural context to all that was happening on the eve of colonisation.... Formidable Asiatic empires from the Ottomans to the Manchus had begun to show signs of decline. The old order was crumbling and the new was yet to emerge and when it did it came via new routes and new knowledge’ (Kumar 2015:) By the seventeenth century, the Dutch and the Portuguese found themselves embroiled in a war along the coastal hinterlands of the Indian Ocean trading world. In 1663, the Dutch gained exclusive access to the pepper trading rights on the Malabar Coast through a treaty they signed with the Raja of Cochin (Chaudhuri 1985). The Malabar Coast shifted from Portuguese to Dutch control and the everyday resources of the indigenous people became highly sought after by a European elite. With trading houses or factories built by the Dutch, pepper, cinnamon and cardamom trade proceeded at a more sophisticated rate. By the end of the 17th century the English East India Company's choice for the location of its main factory on the Malabar Coast was Tellicherry because of its proximity to the pepper producing areas of Kottayam and Randattara. With the British takeover of the sub-continent a number of the territories of the Mughal Empire became British territories (Wallerstein 2011, Prasannan 2011: 21-51). Losing its American colonies had significantly damaged the British shipping industry. However, in the newly won colonies of the Indian Ocean, namely Java and the Malabar Coast, the dense teak forests provided an excellent substitute. By the 1800s, the British Empire’s modes of resource use, well developed trading network and factory system, new technologies to shorten seafaring travel contributed to the next great epoch in the history of globalisation. Richard Tucker, describes Malabar as almost entirely domesticated by global capitalism under the most complex system of resource extraction which any European empire ever established in the developing world’ (Tucker 1989). These new knowledges downgraded Indian cultural traditions and knowledge practices including those of its science which were beginning to be condemned as unscientific and primitive with oriental learning being seen as belonging to the realm of the senses and imagination. This cultural downgrading

of other societies was linked to earlier environmental understandings in the sixteenth and seventeenth centuries.

### **Early Environmental Enquiry and Cultures of Savagery**

Early environmental ideas were driven by the need of empire builders to understand and acclimatize themselves to foreign environments. Europeans regarded the tropical environment with a mixture of promise and terror. The promise, presumed the exuberance of nature in the tropics while the terror derived from the high risk of death that European sojourners faced. We have argued, that the great expansion of European maritime travel and settlement after 1400 stimulated new ways of viewing the relationship between man and nature. As early as the fifteenth century, the newly discovered islands in the Atlantic the Canaries, Madeira were seen as sites of redemption. For Grove, the island metaphor of the Renaissance constituted a vital part of the discourse and culture of early colonialism. As he noted, 'the new world had a strong attraction for renaissance man and 'discovery' gave an opportunity 'to locate gardens of Edens, Arcadias, Elysian fields and Golden ages in a geographical reality (Grove 1995). The new world conceived of in island terms was both desirable for example, as reflected in Columbus's writings in 1492; 'the songs of the little birds are such that one would never desire to part hence' and redemptive freeing one from the constraints of European society.

The reverberations of these imperial mentalities in the realm of Renaissance literary and cultural are well known. For Shakespeare, the location of the *Tempest* provided the setting for speculation about the Edenic qualities of the island and the vision it offered to create an alternative utopian society. Accounts of a shipwreck on the Bermudas prompted Shakespeare to conceive of an island as a meeting place between the indigenous inhabitant and the European colonist. *The Tempest* was also a play about the European response to a new physical environment well as to an indigenous inhabitant. Caliban was probably inspired by Montaigne's writings which built on real stories of travel. For Grove, the *Tempest* debated a whole range of social options and the contradiction between the projection of Edenic or paradisiacal properties on to the island and the empirical complexity of the island in terms of its flora and fauna (Grove 1995:35). The Renaissance had promoted a renewed interest in the value and portrayal of the natural world, as reflected in the *Tempest* which focused on allegedly civilised Europeans as they attempted to relocate themselves in a 'wilderness'.

The Renaissance-era accounts of many of the earliest encounters between Europeans and Amerindians contain reactions towards new world peoples that implied or more directly offered praise for what was perceived to be their 'natural' manner of living. Idealised portrayals of Amerindians in these writings reflect the varied, and at times conflicting, fables about faraway' lands and peoples across

the sea that shaped the experiences and expectations of late fifteenth century and early sixteenth century explorers, missionaries and soldiers who travelled to the America (Marshall and Williams 1972). Imagined visions of distant lands occupied by magical creatures, instantiations of mythological ‘wild men’ or inhabitants of a golden age who were celebrated in song and poetry seems to have helped to create the archive of the idea of the noble savage. Michel de Montaigne’s essay ‘Of Cannibals’ in 1580 drew upon such earlier descriptions but set them in the context of an ongoing discourse about the corruption of European societies and the superior excellence of nature’s treasures, which included for him most of the indigenous inhabitants of the new world who had hardly strayed from their original naturalness. Montaigne’s essay is often interpreted as an ingenious attempt at complicating the idea of savagery, for he directly challenges the view that Amerindians are savage in any pejorative sense. A proper understanding of the term savage, in his view shows that Europeans who have altered themselves and their environments are in fact savagely artificial, rather than naturally pure. As Montaigne argues,

These people are wild (sauvage), just as we call wild (sauvage) the fruits that nature has produced by herself and in her normal course; whereas really it is those that we have challenged artificially and led astray from the common order, that we should rather call wild (sauvage). The former retain alive and vigorous their genuine, their most useful and natural, virtues and properties, which we have debased in the latter in adapting them to gratify our own corrupted taste.<sup>5</sup>

What animates the behaviour of savage peoples given that they lack “culture” as understood by Europeans. The role of climate was central to Montaigne’s understanding of the role of fortune in helping to bring about and maintain savage societies. New world peoples were blessed by an abundance of natural resources. *‘They live in a country with a very pleasant and temperate climate...they have a great abundance of fish and flesh and they eat them with no other artifice than cooking’* (Montaigne 1685). The infantilisation of new world peoples by noble savage writers was meant primarily as an attack upon the decrepitude of European civilisation which they generally viewed as well past its prime. For example, John Locke would assert with confidence in 1680s ‘that in the beginning all the world was America’ (Marshall and Williams 1972: 190).

Shankar Muthu underlines the irony of treating the new world people in these accounts as the earliest, least artificial and most natural humans-- the very attempt to humanise them or to turn their presumed savagery into a badge of honour ultimately cast them as lacking the cultural attributes which would have made them human (Muthu 2009). It is important to note that many of these ideas and representations in real accounts was reflected in fictional accounts and the disillusionment with existing, political, social and religious forms can be seen in

the utopian literature in the seventeenth century which described imaginary voyages to imaginary lands (Ellingson 2001). Writers often had access to ‘real accounts’ due to the extensive voyaging in the period and the boundary between traveller’s fictional accounts and fictional ‘voyages’ was not absolute (Lovejoy 1936). In Defoe’s *Robinson Crusoe*, a solitary man is able to live a virtuous existence and bereft of all mechanical aids and sophistications of civilisation. Both Defoe’s *Crusoe* and Jonathan Swift’s *Gulliver’s Travels* made references to contemporary knowledge shown in traveller’s maps. Historical maps were an aspect of the new textualism of the Renaissance and as exploration shifted attention from the Mediterranean to the Oceanic, historical atlases reflected a growing interest in and understanding of cartography (Black 1997:18). Understanding the role of climate was part of this quest for new knowledge and the links between culture and climate were beginning to be formulated by the seventeenth century.

### **Early Environmental Legislation**

The empirical observation of the damage caused by European empires resulted in a sense of nascent environmental consciousness from a relatively early period. From 1500, the European impact on oceanic islands was documented both as watering holes for ships and due to the fact that practical survival on oceanic islands was difficult. This encouraged wider questions about the sustainability of a confined settlement. Islands soon became symbolic of the explored world and encouraged ideas about limited resources and the need for conservation or sustainability. These early colonial responses to environmental crisis thus allow us to understand global networks of knowledge.

Grove argues for example, that the Caribbean and its littoral, along with Bermuda, has been a very important area for working out the processes going on in world environmental history in the context of European economic expansion and globalization in the early modern period. He has argued for an early transition in attitudes to nature that predate eighteenth century debates. Some of the early travelers like Columbus had been genuinely sustained by their conviction of the locations of discoverable Edens, Indic or otherwise. By the late sixteenth century, as we have seen, growing volumes of capital in connection with agricultural, urban and proto industrial transitions was transforming the world. By the mid seventeenth century colonial plantation investments by European trading companies, (Dutch, English and French) were bringing out rates of soil erosion and deforestation which were marked and commented on by these early naturalists. Indigenous cultures and societies particularly on oceanic islands, such as Canaries, Madeira and the Caribbean were under attack.

It is no accident that the earliest writers to comment specifically on rapid environmental change in the context of empires were naturalists who were

themselves often actors in the process of colonially stimulated environmental change. Grove and Damodaran have argued that the early pioneers of an environmental critique of the European and American empires depended on having an historical perception of rapid rates of ecological change, and access to evidence for rapid change (Grove 1995, Grove and Damodaran 2006). Between 1500 and 1800 the colonial environment presented a different set of problems to the early colonialists compared to metropolitan Europe as ecological pressures were felt much more catastrophically in the colonial margins. The degradational impact of new settlement and plantation agricultures was felt by the early colonists. The cultural impetus independent of the economic motive had also resulted in the widespread clearing of forests in the Caribbean, to enable these landscapes to resemble Europe. The idea of the links between forests, climate and disease had also resulted in extensive forest clearance in the Caribbean. The ecological deterioration that followed made an impact on European observers resulting in environmental enquiry and some early legislation which must be seen in the context of an emergent culture of environmental intervention.

Some of the first comprehensive forest-protection legislation on such colonies was introduced after 1620, in Bermuda and a little later in the Caribbean Leeward Islands. In Montserrat, the mountain forests of the island were protected from felling after 1702 by a rigid ordinance, with the knowledge that unrestricted logging caused soil erosion and flooding on lower grounds and in towns (Grove 1995). The Caribbean islands, with their large settler and slave populations, came under sustained ecological pressure at an early date and, as on Mauritius and St. Helena, awareness quickly grew of the physical changes and extinctions brought about by commercial clearance. As early as 1616, measures had been taken to protect the indigenous edible sea birds in Bermuda. By the mid-18th century, over fishing and major reductions in catches were taking place around many now densely populated islands. Other legislation followed making conservation an integral part of colonial landscape control.

The earliest environmental historians then were these early naturalists and scientists of empire. As early as the mid-seventeenth century we find that intellectuals and natural philosophers such as Richard Norwood and William Sayle in Bermuda,<sup>6</sup> Thomas Tryon<sup>7</sup> in Barbados and Edmond Halley and Isaac Pyke on St Helena were all already well aware of characteristically high rates of soil erosion and deforestation in the colonial tropics, and of the urgent need for conservationist intervention especially to protect forests and threatened species (Grove 1995: 114). Halley, for his part, made the first accurate estimates of the global volume of the oceans and the varying quantities of different elements in marine-land-atmosphere cycling over time<sup>8</sup>. On St Helena and Bermuda this early conservationism led, by 1715, to the gazetting of the first colonial forest reserves and forest protection laws. In the ensuing century, forest-reserve legislation responding to fears of deforestation-induced climate change slowly

began to spread around the world, especially throughout the French, British, and Dutch empires.

The rise of imperial networks of information from 1500 enabled the emergence of a new global environmental awareness as well as the first accurate accounts of global change bringing about an early environmentalism which highlight the older and far more complex antecedents of contemporary conservationist attitudes. The gradual emergence of a complex European epistemology of the global environment should be linked to the cultural dynamics and the pervasive and creative impact of the tropical and colonial experience that challenged European attitudes to nature and transformed the Western and scientific mind after 1500. As Grove argues 'early environmental concerns emerged as a corollary and in some senses as a contradiction to the history of the mental and material colonisation of the world by Europeans' (Grove 1995).

The dynamics of imperial systems are thus central to understanding transformations in world environmental history. Equally important to us, as historians, as the next section of the paper shows is the need to develop an understanding of the conjuncture between extreme climate events, the features of empires and their impacts and organised responses to the environment, especially to events such as the seventeenth century crisis.

### **Climate anomalies, Culture and the Seventeenth Century Crisis**

The seventeenth century crisis and its climatic basis has had significant impact on recent historiography. Using new research in climate history, historians such as Geoffrey Parker, Richard Grove, David Clingingsmith and Jeffrey Williamson have been able to assess the impact of climatic events on historical change and rebellions in the seventeenth and eighteenth century. For Geoffrey Parker and Sam White there is robust evidence that global cooling occurred in the seventeenth century and that it had a dramatic effect on European society, culture and historical events in the period (Parker 2013, White 2011). The idea of a global crisis is here to stay and the fact that climate formed an integral part of it is accepted by these historians. A central premise of these seventeenth century historians is that the synchronicity of the many political disorders of mid-seventeenth century Eurasia was no accident but was dependent on climatic factors. The term seventeenth century crisis was first coined by English Marxist historian Hobsbawm, in *Past and Present* in 1954 and later taken up by Trevor Roper (Hobsbawm 1954, Roper 1959). Climate, which was mentioned regularly by historians of the *Annales* school, but rarely elsewhere, came to be seen as perhaps the most significant driving force behind those upheavals gathered under the term 'crisis'. How do we see the role of climate versus culture in history and how do we avoid crude environmental determinism? By exploring the arguments

on the seventeenth century crisis in the context of Mughal India we hope to answer some of these questions.

For the longer part of its history, and in the overwhelming majority of texts produced that addressed the issue of the seventeenth century, 'General Crisis', the focus has been on Europe. In 1975, Jonathan Israel began to extend the geographical boundaries of the debate in his work to Mexico and the General Crisis of the Seventeenth Century (Israel 1975). Further territorial extension was slow to materialise – suffering no doubt from the general move away from structuralist thinking – indeed, it was more than a decade before the Ming / Qing transition in China was first considered in this connexion by Frederick Wakeman and not until 1990 that a special edition of *Modern Asian Studies*, presenting four articles – all economic histories – on 'The General Crisis in East Asia', introduced to General Crisis theory the study of highly developed economies such as Japan, Indonesia and India (Wakeman 1986). Contributions to this volume from Anthony Reid and William Atwell looked at South East and East Asia respectively, John Richards considered the period in Mughal India, while Neils Steensgaard discussed 'unity in Eurasian history'.<sup>9</sup> Two key communalities can be drawn out of this phase of the historiography in which the debate moved into Asia; firstly the notion of the Crisis as a fundamental transformation between epochs, era or *epistemes*, between old and new, which dominates the historiography of the crisis in Europe faded as identification becomes more a matter of noting the coincidence of a sufficient number of negative incidents encompassing a broad enough geography and sufficiently diverse areas of human life and secondly; climate began to be seen as quite a significant factor in bringing about the crisis first highlighted by the Annales school. This section examines the evidence for a cooling climate and the impact of the seventeenth century crisis on India in the context of the political, military and administrative culture of the Mughal empire.

The Little Ice Age coincided with a two periods of unusually low sunspot activity, the Spörer Minimum (1450–1540) and the Maunder Minimum (1645–1715). Both solar minimums coincided with the coldest years of the Little Ice Age (LIA) in parts of Europe. In the mid fourteenth century, a combination of violent climate oscillation halved Europe's population and caused severe depopulation in Asia. A period of global warming followed and then a very cold period peaking in the mid seventeenth century. Climatologists refer to the period as one of cooler average temperature prevailing at the end of the medieval warming to the beginning of our contemporary era of global warming. The historian Geoffrey Parker, does not engage in this debate he simply appropriates the term to refer to the crisis and the Little Ice Age referring to climatic conditions between 1610 and the winter of 1708-9. Parker notes that three natural forces combine in this period, to generate cooler temperatures and greater climatic variability- reduced solar energy being only one of them, increased volcanic activity and a greater

frequency of El Niño being the other two (Parker 2013).

For Parker, the period was seen to coincide with ENSO or El Nino Southern Oscillation current in the oceans which operates in two distinct phases alternating over a period of roughly 2-7 years. These phases are characterised by warming in the tropical Pacific and the Indian Ocean, often suppresses rainfall in the western Pacific in the case of El Nino and converse in the case of La Nina. ENSO events vary widely in their manner of expression, 'centres of action' duration and depth, but are typically accompanied by extreme weather events. The links of El Nino with Asian Monsoon is important here and the structure of Sea surface temperatures or SSTs in the Indian Ocean is linked to more familiar pattern of SSTs in the Pacific Ocean (Damodaran, Hamilton, Allan, forthcoming). The mid-seventeenth century saw the weakest period of monsoons on record and in the seventeenth century ENSO events happened twice as often. In fact, the period saw the weakest East Asian monsoons of the past two millennia. It was believed that ENSO events also triggered volcanic eruptions and that the global footprint of El Nino events included three regions besides the land adjoining the Pacific, with the Caribbean suffering floods, Ethiopia and north West India experiencing drought and Europe suffering hard winters.

The years of the Little Ice Age coincide well with the Mughal Empire in India. Parker argued convincingly that 'although Europe and East Asia formed the heartland of the General Crisis, the Mughal Empire. . . also experienced episodes of severe political disruption in the mid-seventeenth century' resulting in wide spread violence. The Mughal Empire can be seen as having 'come close to revolution . . . in the 1650s, while the seventeenth century as a whole is described as a period in which wars were fought 'almost continuously' (Parker 2013). Droughts, floods and famines, particularly in the late 1620s and early 1630s in Gujarat and the Deccan are also cited as examples of upheaval. However, the main event by which Parker attempts to bring Mughal India in to the fold of the 'General Crisis' is the 1658-1662 war of succession. This is interesting as much of the violence of the wars of succession should be seen as part of the culture of Mughal rule. Parker notes this but puts it down to climate rather than culture and politics noting 'Yet even this rich empire could not overcome the weaknesses caused by 'bloody tanistry'<sup>10</sup> (Parker 2013). The ruthless wars of succession were indeed built into the very nature of the Mughal system of power transfer – tanistry rather than primogeniture which meant that wars of succession were inevitable and, indeed, occurred with every transfer of power in the period. The Mughals in the seventeenth century enjoyed exceptionally long reigns – Shah Jahan ruled for some thirty years, Aurangzeb for nearer fifty – and serious battles for control of the Empire erupted always toward the end of Emperor's lives as their ability to assert their authority began to wane as it did in the case of Shah Jahan in the late 1650s. In the period 1658-62, Mughal wars of succession caused widespread



hardship and death in a ruinous civil war between brothers Aurangzeb and Dara Shikoh, successors of the emperor Shah Jahan. The crisis of succession in Mughal India and the movement of the armies coincided with another great drought where in Gujarat in 1659, famine and plague once again became apparent creating particularly difficult conditions for the Indian population in the late 1650s and early 1660s. Contemporary reports noted that 'people [are] dying daily . . . the living hardly able to bury the dead' (Agarwal 1983).

What was the environmental impact of the Mughal empire? Historically the Mughals were great tank and canal builders to combat the frequent droughts in their empires. The construction and maintenance of reservoirs was encouraged by rulers (Hardiman 1998). Their impact on the forests of North India however been enormously destructive with increasing agricultural settlement and inroads into the forest frontier at frequent intervals (Gommans 2002). Their introduction of goats had increased soil erosion and their hunting practices had had a negative impact on the wildlife populations of the country. As one writer notes Mughal painters recorded with minute accuracy their landscape through their miniature paintings, animals, birds plants and hunting practices (Rangarajan and Sivaramakrishnan 2012). The emperors all practiced hunting especially Jahangir who killed wildlife indiscriminately including tigers and lions. At the same time their love of gardens and their penchant for tree planting was a very significant part of Mughal culture. During his reign, the emperor Akbar encouraged trees of every description to be planted resembling the trees of paradise and giving shade to tired travellers.

The destruction of forests, the push of the agrarian frontier, the spread of commercial crops and complex systems of tax collection made agricultural communities more vulnerable to famine. The Mughal ruler, Akbar's reign was dominated by two major famines in Gujarat in 1556 and 1595 lasting three years. Abul Fazl the court historian describing the horrors of this famine noted that the mortality was great 'Man ate their own kin and the streets were blocked with corpses' (Agarwal 1983:24). Abdul Qadit Badauni another contemporary historian noted that the whole country was deserted and no husbandmen remained to till the ground (Agarwal 1983:23). In 1595 another famine caused by the failure of rains affected north India especially Kashmir and Lahore. Jesuit missionaries reported that the streets of Lahore were blocked up with human corpses. In 1618-19 there was famine in the Deccan and on the Coromandal coast. The traveller, Methwald who left the East coast in 1622 wrote about the ravages of the famine in Vijaynagara. In the reign of Shahjahan, during the protracted La Nina episode in 1630-31 a severe famine occurred which affected Golconda, Ahmednagar and parts of Malwa. According to Abdul Hamid Lahori, a contemporary historian no rainfall in the Mughal territories of the Deccan and Gujarat. The drought was followed by severe floods. The middle of the seventeenth century, as noted, had

seen the weakest period of monsoons on record and the rains failed in 1646 and 1647. Heavy mortality, was reported from Pulicat and Madras and the traveller William Foster recorded that half the people in the area of Nagapatnam were dead and the stench of the dead bodies and the dying people was terrifying. The first year of Aurangzeb's reign was likewise marked by a famine of intense suffering causing unspeakable suffering in Northern and Central India. Col Tod noted that caste distinctions broke down and that the famine was a great leveller of social divisions, 'there was no longer distinction of caste, Sudra and Brahmin were indistinguishable. Men ate men'. Cities were depopulated and Bihar had a severe famine in 1671 which encouraged the slave trade. In 1687 there was another severe famine that broke out in Golconda. June 1687 saw floods and the city of Hyderabad was depopulated, houses, rivers and plains filled with corpses. From 1704-1707 another great famine hit the Deccan but this famine caused by drought was not so severe as that during the reign of Shah Jahan.

On the face of it then, whilst Parker's interpretation of events in Mughal India as being a result of climatic uncertainty can be justified from contemporary descriptions Parker's claim of 'exceptional violence' in the seventeenth century as a whole is questionable as argued tanistry and wars of succession were part of Mughal politics and culture. Furthermore, the argument sits in some contrast to the historiography, for example, John F. Richards and Irfan Habib and others, who have described the seventeenth century as a period of relative calm and stability (Richards 1990, Habib 1963). Lack of comparative and contextual data on monsoon failure also leaves Parker's argument somewhat open – details of how common these were, their geographic extent, how long they lasted, what traditional coping mechanisms existed, what social and administrative contingencies were in place are needed in order to form any accurate idea of the meaning and significance of monsoon failure in general, and of specific droughts for Indian society. That Parker can point to near continuous warfare is not in itself proof of exceptionalism in a rapidly expanding and militaristic early modern empire, which, throughout its existence, failed to define solid boundaries and was always involved either in expansion or suppression of rebellion somewhere in its vast territory (Edwards and Garrett 1974).

John F. Richards saw no evidence of a seventeenth century crisis in India, identifying instead, continuity and prosperity which endured well into the following century when the region experienced a distinct and unrelated eighteenth century crisis as the Mughal emperors lost power to local lords and later the EIC. Richards' conclusions are not very different from those reached some thirty years earlier by the distinguished economic historian of early modern India, Irfan Habib in his work *The Agrarian System of Mughal India*. For Habib, it was the strength of the Mughal Empire as an administrative unit which was its most remarkable feature; the revolt of 1580 and the Rajput revolt a century later

being practically the only points at which the elite or the theocracy made any play of contesting the power of the semi-divine monarch. Moreover, Habib holds – contrary to Parker – that in the light of the refusal of contesting parties to ever discuss or consider partition, the wars of succession beginning in 1628, 1658 and 1707, should be viewed not as moments of weakness or near collapse, but as markers of the remarkable durability and cohesion of the Empire (Habib 1963).

Habib, emphasises the stability and security afforded by Mughal military supremacy –albeit accompanied by violent suppression and coercion of the masses of peasants and workers – and the extreme – if impermanent – power afforded to the Emperor via the *Jagirdari* system of delegated revenue collection. This system rendered the *Mansabdars* 'completely dependent on the will of the Emperor', and allowed for the collection of taxes which reduced the populace to bare subsistence, producing enormous and highly concentrated wealth for a small elite (Habib 1963:360). The system was, however, fundamentally flawed: Multiple layers of delegation in tax collection, the regular relocation of regional administrators and a lack of central control over these *Zamindars* who were seen as the primary threat to order in the Empire, left the system open to exploitation whereby the masses suffered enormously at the expense of the various layers of the elite (Habib 1963: 317-322). In time, some local lords, particularly in Hindustan began to rebel against centralised power, refusing to pass on revenue. Poor and subjugated elements were drawn to rebellious regions by more tolerable and equitable conditions and thus the power of rebellious elements grew (Habib 1972:366). By the mid-late seventeenth century the Jat, and later the Maratha revolts had become a significant threat to Imperial order – they would eventually be its undoing – yet these were slowly developing and evolving states of confrontation, which spread gradually, slowly eroding centralised power, rather than a well-defined crisis prompting its collapse (Habib 1963: 399-346)

For Clingingsmith and Williamson, it was the eighteenth century which witnessed the most significant upheavals in India's economic and political structure (Clingingsmith and Williamson 2009). Herein, it was seen that the turmoil accompanying the dissolution of the Mughal Empire, into a constellation of smaller states and their forced regrouping under the EIC, frustrated commerce and industry, leading to economic decline. Even here however the notion of crisis, and even of economic decline itself remains controversial and is far from settled as an historic fact. Work by Bayly, Alam and Marshall lays emphasis on continuity rather than disruption, with Mughal administrative units are seen to remain largely intact, pre-existing growth trajectories are maintained and the only major change is in the amount of money passed on by local powers to central Mughal administration (Clingingsmith and Williamson 2009 :2011). It was, furthermore, in the latter part of this era, the years 1700 that 1760, that India reached its peak as a manufacturing centre (2009:223).

Parker's extension of the General Crisis to India then is on much shakier ground than it was in regard to China where at least upheaval – whatever its cause – is beyond contention. In light of the historiographical consensus that the seventeenth century was a time of relative calm in the Mughal Empire and that major upheaval did not occur until the early-mid eighteenth century the attempts to extend the crisis into the subcontinent are considered, at present, in need of more evidence. Parker's arguments, in the case of India, appear to be open to exactly those criticisms which were levelled at those of Hobsbawm, Trevor-Roper and others beyond the 1960s; that levels of upheaval were simply not that exceptional and continuity in systems of power was more marked than transformation. What makes these weather anomalies different from say a century earlier or a century later? Parker asserts that 'the seventeenth century experienced extremes of weather seldom witnessed before or after and never so far since' (Parker 2013). In his analysis LIA possesses a decisive agency revealing itself in striking weather events that intervened in historical processes influencing the outcome of battles, destroying empires. The claim requires comparative and quantitative evidence, more detailed work on documentary and paleo sources. Furthermore, in terms of climate it is important to note that impacts are always asymmetric, simplistic notions such as weak or strong monsoons or intense El Niño episodes do no justice for the possibilities of variation in mode of expression and centres of action of these climate events. A more useful approach then, is one that focuses on regional and national differences and the resilience of agricultural communities and their production strategies in the face of population pressure, exogenous shocks and environmental change. Famine causation is complex and links between drought and famine needs to be re-assessed in the early modern period. Despite these caveats, there is a strong need to develop a database with that will help us put together a clear famine series, climate series, disease series, wage series and price series for South Asia and the Indian Ocean world from 1500-1900 which is currently woefully inadequate.

The paper has shown the ways in which history of the early modern imperial world can be enriched by these recent trends in historiography in terms of a global environmental and climate history. In brief, early colonialism brought about step changes in rates of environmental and landscape change with early island plantation agriculture, hunting and fishing and also in terms of environmental information collection, storage and transmission. Colonialism of this kind enabled new cultural imaginings and the collection of systematic data on oceanic islands through the establishment of colonial botanic gardens with the employment of scientists as surveyors and naturalists from 1500. By actively promoting and enabling the journeys of travellers and artists, European colonial empires encouraged the systematic organisation and cultures of natural history

and global botany. By the beginning of the seventeenth century as we have shown, this had resulted in some nascent conservation legislation. Studying imperial systems is thus central to understanding transformations in world environmental history. Equally important to us, as historians, as the second section of the paper shows is the need to develop an understanding of the conjuncture between extreme climate events, the dynamics of empires, their military and administrative cultures and in turn their environmental impacts and their organised responses to anomalous events such as the seventeenth century crisis.

## References

- Abu-Lughod, Jane ([1989] 2005) *Before European hegemony: the world system: 1250-1350*, New York, Oxford University Press
- Adams W.M. (2004) *Against extinction: the story of conservation*, London, Earthscan
- Agarwal, C.M., (1984) *Natural calamities and the great Mughals*, Delhi, Kanchan publishers
- Alam, M.,(1998) *The Mughal state, 1526-1750*, Delhi, Oxford University Press
- Arnold, David, (2000) 'Illusory riches: representations of the tropical world, 1840-1950. *Singapore Journal of tropical geography*, 21, 1:6-18
- Atwell, William, (1990) 'A Seventeenth Century General Crisis in East Asia, *Modern Asian Studies*, Vol. 21, 4: 621-682
- Bayly, Chris (1993) *Rulers, townsmen and bazars, North Indian Society in the age of expansion*, Cambridge, Cambridge University Press.
- Beinart W. and J. McGregor, (2003) *Social History and African environments*, Oxford, James Curry
- Beinart William and Lotte Hughes, (2007) *Environment and empire*, Oxford, Oxford University Press
- Black, Jeremy (1997) *Maps and History; constructing images of the past*, Yale university press, Yale
- Chaudhuri, K.N.,(1985) *Trade and civilization in the Indian Ocean: an economic history from the rise of Islam*, Cambridge University Press, Cambridge.
- Clingingsmith David and Jeffery G.Williamson, (2009) 'Deindustrialization in 18th and 19th century India: Mughal decline, climate shocks and British industrial ascent, *Explorations in Economic History*, Vol. 45, issue 3: 209-234
- Constanzas, Robert, Lisa J.Graumlich and Will Steffan, ed. (2006) *Sustainability or collapse; Integrated history and future of people on earth*, MIT Press, Cambridge
- Corona, Gabriella, ed., (2008) 'What is global history?', Global Forum, *Global Environment*, no 2
- Crosby, Alfred, (2004) *Ecological imperialism, the biological expansion of Europe, 900-1900*, Cambridge

Damodaran, Vinita Rob Allan and James Hamilton,(forthcoming) 'Climate signals, environment and livelihoods in seventeenth century India in a comparative context' in Ayesha Mukherjee ed. *A cultural History of Famine*, Routledge

Dovers, S., R. Edgecomb and B. Guest, (2002)*South Africa's environmental history, cases and comparisons*, Ohio University Press, Ohio

Driver, Felix (2004) 'Imagining the tropics: views and visions of the tropical world' *Singapore Journal of tropical geography*, 25, 11:1-17

Edwards S.M. and H.M.O. Garrett, (1974)*Mughal rule in India*, London, Luzac

Elvin, Mark (2004) *The retreat of the elephants, an environmental history of China*, Yale University Press, Yale

Ellingson, Ter (2001) *The myth of the Noble savage*, University of California Press, Berkley and California

Ford, Caroline, (2007)'Natures fortunes: new directions in the writing of European environmental history' *The journal of modern history*, 79, March 2:112-133

Lovejoy, Arthur (1936)*The great chain of being, a study of the history of an idea*, Cambridge University Press, Cambridge.

Gommans Jos, (2002) *Mughal Warfare*, London, Routledge

Grove, Richard (1995) *Green imperialism, colonial expansion, tropical island Edens and the origins of environmentalism, 1600-1860*, Cambridge, Cambridge University Press

Grove Richard and V. Damodaran, (2006) 'imperialism, intellectual networks and environmental change, origins and evolution of global environmental history, 1676-2000' *Economic and political weekly*, Parts 1 and 2, October 14<sup>th</sup> and October 21<sup>st</sup>, vol. 41, 41: 4345-4354 vol. 42

Habib, I (1963) *The Agrarian System of Mughal India*, Asia publishing house, Aligarh

Halley, Edmond (1694)'An account of the circulation of watry vapours of the sea and of the cause of springs', *Philosophical Transactions of the Royal Society*, 192:17: 468-73

Hardiman, David. (1998) 'Well irrigation in Gujerat; systems of use, hierarchies of control, *Economic and Political weekly*, vol. 33, no. 25: 1533-1544

Hobsbawm, E.J. (1954)*The general crisis of the seventeenth century*, Past and Present, no 5:33-53

Israel, J, (1974) *Mexico and the General Crisis of the Seventeenth Century*, Past and Present, 63: 33-57

Kumar, Deepak,(2015) 'Botanical explorations and the East India Company: revisiting 'Plant colonialism'in Vinita Damodaran, Anna Winterbottom and Alan Lester ed., *The East India Company and the Natural World*, London, Palgrave

Lefroy, J.H., (1879) *Memorials of the discovery and early settlement of the Bermudas or Somers Islands, 1515-1685. Comp. from the colonial records and other original sources*, London, Longmans, Green, and co.

Mackay, D.(1985) *In the wake of cook; exploration, science and Empire, 1780-1801*, Victoria University Press, Wellington

Macpike E.F. ed., (1932) *Correspondence and papers of Edmond Halley, preceded by an unpublished memoir of his life by one of his contemporaries and the 'Éloge' by D'Ortous de Mairan*, Oxford, The Clarendon press.

Marshall, Peter, Glyndwyr Williams, (1982) *The great map of mankind; British perceptions of the world in the age of enlightenment*, Dent

McNeill, John (2003) 'Observations on the nature and culture of environmental history, *History and theory*, 42 : 5-43

Montaigne Michael de ([1685]2002)*The complete essays of Michael de Montaigne* Chapter 31 'of the cannibals', Stanford University Press , Stanford

Morris Brian (2006)'The ivory trade and chiefdoms in pre-colonial Malawi' in *The Society of Malawi Journal*, vol. 55, no 2: 6-23

Muthu, Shankar, (2009)*Enlightenment against empire*, Princeton University Press

Parker G. and L.M. Smith ed., ([1978] 1997) *The general crisis of the seventeenth century*, London, Routledge

Parker Geoffrey (2013) in *Global Crisis, War, Climate change and catastrophe in the seventeenth century*, Yale University Press, Yale

Pomeranz, K. (2000) *The great divergence; China, Europe and the making of the modern world economy*, Princeton University Press, Princeton

Prasannan Parthasarathi (2011) *Why Europe grew rich and Asia did not; global economic divergence, 1600-1850*, Cambridge University Press, New York

Rangarajan, M and K. Sivaramakrishnan, (2012) *India's environmental history from ancient times to the colonial period*, Permanent Black, Ranikhet

Reid Anthony (1990)'The Crisis of the Seventeenth Century in Southeast Asia' *Modern Asian Studies*, vol. 24, 4: 639-659

Richards, John (1990) 'The Seventeenth Century Crisis in South Asia' *Modern Asian Studies* , vol. 24, 4:625-638

Richards, John F. (2003) *The unending frontier; an environmental history of the early modern world*, University of California Press, Berkeley

Steensgaard Neils (1990)'The Seventeenth Century Crisis and Unity in Eurasian History' *Modern Asian Studies* , vol. 24, 4:683-697

Trevor-Roper, H.R. (1959) 'The general crisis of the seventeenth century', *Past and Present*, no. 16:31-64

Tryon, Thomas (1684) *Friendly advice to the gentlemen-planters of the East and West Indies : in three parts* by Philotheos Physiologus *alias* ] Printed by Andrew Sowle, London.

Thrower Norman J. W. and Clarence Glacken (1968) *The terraqueous globe: the history of geography and cartography*; papers read at a Clark Library seminar, April 27

Tucker, Richard ( 'The depletion of India's forests under British imperialism: plantation forestry and peasants in Assam and Kerala' In Donald Worster, *The ends of the earth*, pp. 118-140

Wallerstein, Immanuel, ([1974]2011)*The Modern World System, 1: Capitalist agriculture and the origins of the European world economy*, University of California Press, Berkley.

Wakeman, F. (1986) 'China and the Seventeenth Century Crisis' *Late Imperial China* Vol. 7.1:1-26

Sam White (2011) *Climate of Rebellion in the Early Modern Ottoman Empire*, Cambridge University Press, New York

Anna Winterbottom, (2016)*Hybrid knowledge in the early East India Company World*, London, Palgrave.

Worster, Donald, ([1977]1994) *Nature's economy, a history of ecological ideas*, Cambridge University Press, Cambridge.



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<sup>1</sup> The term Anthropocene is a term used by scientists to refer to a period of anthropogenically driven climate change when humans have become a geological force transforming the earth's atmosphere.

<sup>2</sup> Brian Morris 'The ivory trade and chiefdoms in pre-colonial Malawi' in *The Society of Malawi Journal*, 2006. Studies that do offer global comparisons include W. Beinart and Lotte Hughes, *Environment and empire*, Oxford, 2007, for the twentieth century story of conservation see W.M. Adams 'Against extinction: the story of conservation', Earthscan 2004, see also S. Dovers, R. Edgecomb and B. Guest, *South Africa's environmental history, cases and comparisons*, 2002, W. Beinart and J. McGregor, *Social History and African environments*, 2003

<sup>3</sup> This carried on into a later period. See Felix Driver, 'imagining the tropics: views and visions of the tropical world' *Singapore Journal of tropical geography*, 25, 11, 2004 and David Arnold, 'Illusory riches: representations of the tropical world, 1840-1950. *Singapore Journal of tropical geography*, 21, 1, 2000, p. 7

<sup>4</sup> The Mughal empire was spread over large parts of north and central India and the Deccan plateau with long periods of rule by emperors, Akbar 1556-1605, Jahangir, 1605-1627, Shahjahan, 1628-1659, and Aurangzeb, 1659-1707

<sup>5</sup> *The essays of Michael de Montaigne* reprinted from first edition, 1685-6, Chapter xxx 'Of cannibals'.

<sup>6</sup> *Memorials of the discovery and early settlement of the Bermudas or Somers Islands, 1515-1685. Comp. from the colonial records and other original sources*, by Major-General J. H. Lefroy. London, Longmans, Green, and co., 1877-79

<sup>7</sup> Thomas Tryon, *Friendly advice to the gentlemen-planters of the East and West Indies : in three parts* by Philotheos Physiologus alias ] Printed by Andrew Sowle, London, 1684

<sup>8</sup> Edmond Halley, 'An account of the circulation of watry vapours of the sea and of the cause of springs', *Philosophical Transactions of the Royal Society*, 192:17, (1694), 468-73; *Correspondence and papers of Edmond Halley, preceded by an unpublished memoir of his life by one of his contemporaries and the 'Éloge' by D'Ortous de Mairan*; edited by Eugene Fairfield MacPike. Oxford, The Clarendon press, 1932; *The terraqueous globe: the history of geography and cartography*; papers read at a Clark Library seminar, April 27, 1968, by Norman J. W. Thrower and Clarence J. Glacken.

<sup>9</sup> The Four articles were William Atwell, 'A Seventeenth Century General Crisis in East Asia', Anthony Reid 'The Crisis of the Seventeenth Century in Southeast Asia', John Richards, 'The Seventeenth Century Crisis in South Asia' and Neils Steensgaard 'The Seventeenth Century Crisis and Unity in Eurasian History' in *Modern Asian Studies*, 1990. See also G. Parker and L.M. Smith ed., *The general crisis of the seventeenth century*, London, 1978

<sup>10</sup> Tanistry refers here to the competition – often military – for power between families, dynasties, siblings, fathers and sons, rather than inheritance of power.